

# Navy Assessing the Treatment of Synthetic Fluids

## Little Known about Environmental Impact

**T**he use of synthetic fluids (i.e. lubricants and other fluids) in place of traditional petroleum-based fluids has become a relatively common practice in today's Navy. Fluids synthesized for specific applications can offer enhanced performance and/or extended service life. Synthetic fluids usage is an important aspect in attaining the Navy's goal of minimizing required maintenance for shipboard equipment. However, while synthetic fluids provide many benefits, their physical properties are often significantly different from their organic counterparts, and their environmental impacts must be carefully assessed.

The Fleet's governing discharge regulations for oily waste are stated in the Office of the Chief of Naval Operations (OPNAV) Instruction 5090.1C, where overboard discharge oil content is to be limited to 15 parts per million (ppm). The Navy has implemented environmental equipment to ensure compliance with the Fleet regulations. The Oil Pollution Abatement (OPA) system is a combination of equipment designed for the collection and treatment of shipboard-generated oily wastes. Treated bilge water under 15 ppm is discharged overboard, while the treated bilge water above 15 ppm is reprocessed for additional treatment.

With a few exceptions, nearly all of the OPA systems installed in the Fleet today

rely on the familiar principle of oils having lower specific gravities or densities than that of water. Stated simply, oil floats on water. The current Navy and many commercial OPA technologies are also based on this principle. However, some synthetic lubricants, as well as hydraulic fluids and cleaners, have specific gravities that are close to or even greater than that of water. Treatment for these fluids is difficult and in many cases impossible when relying on conventional treatment technologies. Ultrafiltration membrane technology is entering the Fleet and may provide a partial solution to the problem of treating synthetics with high specific gravities. This technology is essentially a water purification system, which uses physical barriers to remove hydrocarbons and other contaminants from bilgewater. However, its performance in treating synthetic fluids is yet unknown.

Although synthetic lubricants and fluids can offer increased performance, the "cradle to the grave" philosophy must be applied to ensure environmentally safe management of the spent synthetic oils.

## The IDR's 14 Targeted Specifications

Specifications	Federal Supply Code	Volume Procured* (in gallons)	Number of Preventative Maintenance Schedule (PMS) Citations
MIL-PRF-23699F	9150	678,094	80
MIL-PRF-83282D(1)	9150	271,483	40
MIL-H-22072C NOT 1	9150	109,664	24
DOD-PRF-85734	9150	85,255	None**
MIL-PRF-5559(S/S by A-A-59290)	9150	66,614	None**
MIL-H-19457D	9150	52,334	11
MIL-PRF-85704C	6850	29,982	20
MIL-H-81829 (S/S by SAE-AMS-H-81829)	6850	3,643	None**
MIL-S-8660 (S/S by SAE-AS8660)	6850	3,366	1,633
MIL-PRF-46170D	9150	1,032	None**
VV-D-1078D NOT 2 (Inactive)	9150	1,025	None**
MIL-PRF-7808L	9150	688	None**
DOD-PRF-24574(2)	9150	105	None**
MIL-PRF-87257B	9150	N/A	None**

\* Procurement data from May 2004–April 2006

\*\* No PMS actions related to specification

Because current OPA equipment may not be capable of treating synthetic fluids, the time required to process and reprocess a ship's daily generated oily waste could increase, assuming the synthetic fluids can be detected like traditional oils by existing oil content monitors. If the synthetics cannot be accurately detected, an even worse scenario could develop—effluent containing high oil content could be incorrectly discharged. Both situations are undesirable; excessive processing times accelerate machinery wear and the discharge of high oil content could potentially result in legal action against the ship for the illegal discharge of oily waste.

Synthetic fluids are known to be a potential issue with regard to treatment; however, little is known as to the depth of the problem and the potential future impacts resulting from their increased usage, both shipboard and shoreside. Therefore, in May 2006, the Office of Naval Research (ONR) sponsored the Naval Surface Warfare Center, Carderock Division (NSWCCD) to conduct a preliminary assessment of treating synthetic lubricants, fluids and cleaners in the form of an Initiation Decision Report (IDR).

During the development of the IDR, the Environmental Quality Division of NSWCCD was in contact with representatives from other organizations including the U.S. Coast Guard, Military

Sealift Command, North Atlantic Treaty Organization, other foreign Navies and Naval Facilities Engineering Service Center for potential information and experiences. Also, input from representatives of future ship program offices such as CVN 77 and CVN 78 (aircraft carriers); DDG 1000 (destroyer), LCS (Littoral Combat Ship), and LHA(R) (amphibious assault ship) was included in an effort to inform the Navy's plans for introducing additional synthetic fluids into the Fleet. In addition, the Environmental Quality Division compiled procurement information from the Naval Inventory Control Point to identify the synthetic lubricants, fluids and cleaners that are currently in use by the Fleet. Procurement information from approximately 1,000 records



The OPB-10NP Oil Water Separator.

Photo by Sang Lee

from the Shipboard Hazardous Materials List was collected and reviewed. The records were then associated to their respective procurement specifications and reviewed to determine which were synthetic fluids. Based on all of the information received from the various organizations, future ship programs and the procurement data, 14 specifications were targeted in the IDR. (See the table on the previous page for details on targeted specifications.)

The IDR conducted risk assessments on the impact of the targeted specifications to each component of the OPA system: oily waste transfer system, oily waste treatment system and oily waste monitoring system. Additionally, the compliance with environmental regulations and policies were reviewed for specific applicability towards synthetic fluids. The IDR concluded with recommendations to proceed with experimental investigation into the impacts of synthetic fluids to OPA equipment, both shipboard and shoreside.

In April 2008, ONR directed the NSWCCD Environmental Quality Division to continue the investigation into the impacts of synthetic fluids on Navy shipboard OPA equipment. The investigation includes the development of a standardized protocol to evaluate the impacts of any synthetic fluid on OPA equipment. Within each of the 14 targeted specifications are a number of qualified products, ranging from just a few to over a hundred, that all meet the specification requirements. The protocol will initially be executed on a selected group of products. Throughout the investigation, the protocol will be edited and improved to effectively evaluate the impact of each synthetic fluid on the OPA equipment. This initial protocol development is one of the preliminary steps into the overall research, development, test and evaluation of synthetic fluids management in the Navy.

Although synthetic lubricants and fluids can offer increased performance, the “cradle to the grave” philosophy must be applied to ensure environmentally safe management of the spent synthetic oils. Research and development into improved technologies must not ignore environmental impacts and concerns, but rather progress together. ⚓



An Ultrafiltration Membrane System.

Photo by David Maribo

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